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ANN in decision support for strategic planning of water network management

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Title of Abstract

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Abstract

In Sweden, 15–20% of drinking water is wasted by leakage. Leakage affects both the environment and the economy but relates also to social vulnerability and health. An Artificial Neural Network (ANN) model, which identifies drinking water pipes at the greatest risk of leakage, has been developed. The current work on water network maintenance is often reactive, you repair leaks as you become aware of them, sometimes to great costs if the leak is extensive and acute. Renewal planning is often governed by external factors, e.g., that the street office is planning a street renovation.

The relation between pipe properties and leakage is complex, with no clear correlations. With the ANN model, we want to put "glasses" on the water utilities in order for them to clearly see pipes in poor condition. The model does not produce any new data, but uses data already systematically collected by the water utilities (material, year of construction, pressure levels, etc.) or that they have access to through others (soil, traffic loads, demographics, etc.) in order to calculate the probability of failure for each individual pipe.

The ANN model was compared with pipe failures after the data collection, which showed that it can provide statistically reliable predictions of leakage rates. The results also showed that differences in leakage frequency per length of pipe sections, an index that is often used in operations by water utilities, could be predicted with high statistical reliability.

In order to improve the data quality for network management, the input dataset for each water network was analysed and the most important pipe properties for ANN modelling were identified.

While the ANN model was originally developed for the water utility of Stockholm (SVOA), it has been used also for VA SYD (Burlöv, Eslöv, Lomma, Lund & Malmö), Vakin (Umeå & Vindeln) and Gothenburg in close relationship with researchers at Lund University.

The aim of the model is to give water staff a smart tool for decision support. At the same time, we want to break the old mind-set of many utilities and gather some of the most proactive utilities in a utility-driven research project. We also work to spread knowledge about AI technology to other Swedish water utilities.

Please provide a minimum of two measurable learning objectives that the audience will take away from this presentation.

ANN can be integrated as a decision support tool for water network management.

The ANN model provides statistically reliable predictions of leakage rates.

Please briefly describe what qualifies you to deliver content related to this abstract topic. Have you previously presented on a similar topic?

Research study on the topic in close partnership with nine water utilities companies in Sweden.